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...THE...

AMERICAN FERTILIZER

"That man is a benefactor to his race who makes two blades of grass to grow where but one grew before."

Vol. 93 AUGUST 3, 1940 No. 3

A Century of Plant Food Progress

By CHARLES J. BRAND

Executive Secretary and Treasurer, The National Fertilizer Association

An Address before the Sixteenth Annual Convention, June 4, 1940, White Sulphur Springs, W. Va.

NO matter what yardstick you use as a measure, a hundred years is a long time to mere human beings. But to a nation, an institution, or an industry a century can be a long, long time or a very short time in terms of changes that take place during its running.

There were the dead centuries during Europe's Middle Ages when time stood still and men went hungry and their minds were stagnant.

And there is the past century, since the period of the Industrial Revolution, which has wrought changes in our lives so swiftly that mankind's common sense stumbles keeping pace. In 1840 the population of the United States was 17,690,000—in 1940 it is estimated to be 132,000,000. In one century the seas, the land, and the air have been spread with networks of speed. Yet, of the preceding centuries, it has been written that "Nothing swifter than a horse was known to Nebuchadnezzar or to Thomas Jefferson."

The same thought might be applied to the fertilizer industry. It occupies a field in which there was little or no conscious progress for more than 2,000 years.

In a sense, modern agriculture. so far as it relates to physical and mechanical factors, began with Jethro Tull, who died just 200 years ago. When Tull, a scholar, musician, traveler, and lawyer, settled down on his farm in Crownmarsh Parish, England, for his health with his young wife, and found himself in trouble with inefficient farm help, he began to think of ways out. He devised a method of planting wheat and root crops in rows and was the inventor of the first practical grain drill and horse hoe.

In his time, crop nutrition and the chemistry of the soil were so little known that he thought that if the soil were made fine enough by cultivation, plants could actually absorb the soil particles and the land could therefore produce generous crops forever.

It is not the practice of manuring that was novel between 1800 and 1840, but rather the wide choice of fertilizing substances that began to be recognized and used within that period. Their composition, concentration, portability, and consequent value opened up a new vista for the agriculture of the world which even yet after a century and a half is relatively unexplored.

Early Fertilizers

Ashes and manures of various kinds were articles of commerce during the seventeenth and eighteenth centuries, but it was not until the nineteenth century that the foundations of the commercial plant food industry as we now know it began to be laid. Up to 1800, animal and plant residues, lime, marl, ashes, and, near the oceans, sea weeds pretty much constituted the farmer's choice of materials for feeding his crops.

About 1800 things began to break. Sir Humphrey Davy, in 1803, summarized the accumulated knowledge concerning the connection of chemistry with vegetable physiology in a series of six lectures before the British Board of Agriculture. Nicholas Theodore de Saussure of Geneva, son of a famous Swiss botanist, published his results proving that plants derive

their carbon and oxygen from the air and their nitrogen and their mineral matter from the soil. Albrecht Thaer of Germany came out with his "Humus Theory" which held that the decaying organic matter in soils was the universal nutrient of plants, based on his analyses of plants and his study of soils. In the midst of this, Alexander von Humboldt, the great German traveler and botanist, and later benefactor of Von Liebig, during the course of his classic botanical research in South America from 1799 to 1804, sent home from Callao, Peru, in 1802, the first sample of Peruvian guano to be received in Europe, or elsewhere for that matter.

The Agricultural Revolution

It is now just a century since Justus von Liebig of the University of Giessen suggested the mineral theory of plant food. This was done in an historic address before the British Association for the Advancement of Science in London in 1840.

Liebig was born May 12, 1803, at Darmstadt, Germany, where his father manufactured and dealt in coloring materials. At 16 he finished his gymnasial education. In 1822, at the age of 19, he received his Ph.D. at the University of Erlangen and went at once to Paris where von Humboldt got him the invitation to work with Gay-Lussac, the great French chemist. In 1824, he went to the University of Giessen in Hesse, where he was made a full professor and established his famous laboratory in 1825. He remained at Giessen until 1852, 28 years; then he went to the University of Munich, where he died April 18, 1873.

Between 1825 and 1840, Liebig had become one of the foremost chemists of his time, chiefly for his work in methods of organic analysis, in the fields of agricultural and physiological chemistry, and in establishing firmly the laboratory method of instruction. His work on superphosphate was only one of many fruitful activities during this period. In 1832, his work with chlorine and alcohol had resulted in the discovery of chloroform and chloral.

In 1830, just a decade before Liebig published his "Chemistry in its Applications to Agriculture and Physiology," nitrate of soda was first imported from Chile to Norfolk, Virginia. The first consignment to England had been sent in 1820. Upon arrival, being threatened with a heavy import duty, it was thrown overboard. The first cargo shipped to the United States in 1830 found no purchasers so it was sent on to Liverpool, but finding no buyer there it was brought back again. Finally, in 1831, cargoes were retained in both France and England and the trade grew rapidly. In 1850, nearly 240,000 metric tons were shipped out of Chile.

The year 1840 saw the production in England of the first by-product ammonia salts. These were destined for years to be the principal source of nitrogen for the plant food industry.

In 1845, von Liebig again made a noteworthy contribution when he demonstrated the value of potash in plant nutrition. For years, potash had been used in crop production in the form of wood ashes, but the fact that the beneficial effects obtained were due to the potash content was not known. Importation of mined potash salts into the United States began about 1869 or 1870, though commercial use in Europe started about 1860.

Mixed fertilizers seem to have been made for the first time in the factory of Chappell and Davison, Baltimore, during 1849 or 1850. The census for 1850 indicated that of seven fertilizer factories in the United States, four were located in Baltimore which was the center of the industry even in that early date.

The first record of superphosphate production in America also attaches to Baltimore and took place in 1852.

Baugh and Sons Company of Baltimore, organized by John P. Baugh and his two sons Edwin and Daniel in 1855, was the first firm of which we have record that was organized expressly for the purpose of manufacturing fertilizer and that has retained its identity and activity unbroken to the present day.

By 1860 there were 47 fertilizer plants operating in the United States and they are believed to have produced around 35,000 tons of fertilizer that year.

New Sources of Raw Materials

By 1860 much knowledge had accumulated as to the proper ratios of plant food to produce the best results. The superiority of superphosphate as a source of available phosphoric acid had been demonstrated but there was a scarcity of bones to acidulate and these were the leading raw materials at that time.

At this juncture the phosphate rock deposits of South Carolina were recognized as a valuable source of raw material for superphosphate manufacture. The existence of the deposits had been known for some years but it was not until 1867 that their value was fully proven and mining operations started. These continued for over fifty years and more than 13,000,000 tons of rock were taken from the South Carolina field. Until 1888, they were the sole source of supply; in that year the

more recently discovered land and rock pebble deposits of Florida began actively to compete with the South Carolina production.

The Florida deposits were of higher grade and easier to mine than the South Carolina rock. They rapidly captured the main part of the market and retain it to this day.

In 1894 deposits of phosphate rock were discovered in Tennessee and production began at once. Now Tennessee produces from one-fourth to one-fifth of the total tonnage, with Florida furnishing nearly all of the remainder which has averaged more than 2,500,000 tons a year for the last ten years.

In 1906, huge deposits of phosphate rock were discovered in the Intermountain country, particularly in the States of Utah, Idaho, Montana, and Wyoming. Mining operations at Conda, Idaho, and concentrated superphosphate production (45 per cent) from Idaho rock at Anaconda, Montana, began in 1920. The great distance from the consuming centers occasioning high transportation costs has inhibited extensive development.

The most reliable authorities estimate that the known reserves of high-grade phosphate rock are sufficient to supply our demands for from 3,000 to 5,000 years. We also have an enormous reserve of low-grade rock that can be used if and when it becomes necessary.

In 1893, the production of by-product sulphate of ammonia began in this country. Its use has increased steadily.

In 1895, a process for fixing atmospheric nitrogen was discovered by two German chemists, Frank and Caro, and in 1910 the production of calcium cyanamide under their patents began in the plant of the American Cyanamid Company at Niagara Falls. This plant continues to be one of the largest and most efficient in the world.

In 1919, the cyanamide equivalent of 270 tons of nitrogen was produced in the war-time plant of the United States at Muscle Shoals. There the United States had built two plants, a cyanamide and a Haber-Bosch synthetic plant at a total cost of about $80,000,000. The synthetic plant never produced a ton of nitrogen and the cyanamide plant has produced none since the original 270 tons which qualified the plant for delivery on the Government's construction contract.

Prior to, during, and immediately after the World War, much experience in nitrogen fixation was gained by the research workers of private industry and of Government. In 1921, the synthetic plant of the Atmospheric Nitrogen Corporation at Syracuse, New York, produced 3,000 tons of nitrogen by the Haber synthetic process. This production was in the form of synthetic ammonium sulphate.

In 1926, at Belle, West Virginia, the du Ponts began the manufacture of ammonia solutions.

In 1929, at Hopewell, Virginia, the synthetic manufacture of nitrate of soda began in the Allied Chemical and Dye Corporation plant.

Today, in case of necessity, we could separate ourselves from the world trade in nitrogen, increase our production capacity promptly, and provide all of our own needs, as the supply of air nitrogen is inexhaustable. Each acre of the world's surface has above it 34,500 tons of nitrogen. The spectre of nitrogen starvation that Sir William Crooks thought he saw when he made his address to the British Association for the Advancement of Science in 1898 is forever laid.

Sulphur and Pyrites

In 1865, prospectors searching for oil, discovered enormous deposits of sulphur, in the form of brimstone, along the Louisiana Gulf Coast. The nature of the deposits and the overlying strata made it impossible to mine the sulphur by ordinary mining technology. This situation delayed the exploitation of the Louisiana sulphur deposits for a period of years.

In 1891, after nearly twenty years of research, Herman Frasch patented his famous and revolutionary process of sulphur extraction. Superheated water and compressed air are forced into the deposit thousands of feet underground through three-channeled, concentric pipes. The hot water forced downward through the outer channel melts the brimstone, while compressed air forced down the small inner pipe, forces the molten sulphur up through the middle pipe.

So far as present known reserves are concerned, the United States has the largest sulphur deposits in the world. It so handled its foreign trade in this surplus that it protected the development of other necessary mines in Sicily; thus making for more adequate world supplies of this important element.

No statement concerning the manufacture of superphosphate by sulphuric acid acidulation would be complete without saying something about pyrites. Prior to 1914, brimstone supplied only 2.2 per cent of the sulphur used in the manufacture of sulphuric acid. Pyrites and by-products provided the other 97.8 per cent. The radical change in this situation which has taken place is indicated by the fact that brimstone now provides 66 per cent, pyrites 17 per cent, and smelter fumes 17 per cent.

The Growth of Fertilizer Consumption

Decennial fertilizer consumption figures for the United States were first issued by the Census Bureau for 1880. That year, 1,150,000 tons were used. A. L. Mehring of the United States Department of Agriculture estimates that 15,000 tons of chemical nitrogen carriers, mostly sulphate of ammonia and nitrate of soda, and 203,000 tons of natural organic nitrogen carriers in the form of vegetable meals, tankages, guanos, and manures, were included in the 1880 tonnage.

In a printed volume that we have in our Association library entitled "Abstract of the minutes of The National Fertilizer Association, on August 29, 1883, in Baltimore," the President of the Association, Charles Richardson, of Walton, Whann, and Company, of Baltimore, in his opening address to the convention made the following statement:

"The manufacture of commercial fertilizers was almost unknown in this country some twenty years ago, while today some 800,000 tons are produced annually, representing a value of $25,000,000, or one-tenth of the value of the entire cotton crop of the country."

When these figures are compared with the 1880 figures, it becomes apparent that the fertilizer industry of those early years suffered from the same violent fluctuations in consumption that are still characteristic of it. In days of yore the specific explanation for variation was much the same as it is now, namely, variation in farm income. As between 1880 and 1883, however, it was specifically the loss of income from cotton that caused the sharp drop from 1,150,000 to about 800,000 tons, a drop of 30 per cent. Cotton income in 1880 was $312,000,000 while in 1883 it was $252,000,000.

Fertilizer Control Legislation

As early as 1855, Dr. Samuel W. Johnson, later Director of the Connecticut Agricultural Experiment Station "resumed his work of analysis and valuation of fertilizers for the information and protection of farmers" at the Yale Scientific School.

In 1858, the Maryland Agricultural College, now the University of Maryland, which had been established in 1856, began field experiments with corn, oats, and potatoes, "to test the relative value of the different manures offered for sale in the cities of Baltimore and Washington."

In 1867, Levi Stockbridge, who had studied the works of Liebig, Lawes, and Gilbert, began his experiments with commercial fertilizers at Massachusetts Agricultural College. Associated with Stockbridge was Dr. Charles J. Goessmann, a graduate of the University of Goettingen, who came to the United States in 1857, and from then until 1868 was connected with commercial concerns, having to do among other things with fertilizer manufacture. He joined the staff at Amherst in 1868 to analyze commercial fertilizers and study the problems connected with their manufacture and use.

In 1869, the commonwealth of Massachusetts passed the first State fertilizer control law. It was an open-formula law with strict requirements and severe penalties. It was so impractical that no attempt was made to enforce it. Stockbridge and Goessmann and others recognized that there were no known methods of analysis at that time that would permit the determination of all ingredients used in mixtures, let alone the amount of each. Even today such methods are unknown as was shown in our litigation relating to the South Carolina open-formula law which we carried to the United States Supreme Court in 1936.

As a result of Director Goessmann's work and his report on analyses of commercial fertilizers, the Massachusetts Fertilizer Control Act of May 26, 1873 was passed. This was the first practical law in the United States providing for official inspection of fertilizers and Doctor Goessmann was the first State Inspector of Fertilizers.

Today, forty-seven of our states have fertilizer control laws. Nevada is the only state without such a law. All of these are uniform to the extent that the primary plant foods must be guaranteed in terms of nitrogen, available phosphoric acid, and potash, and in that order. These guarantees are required to be made in whole numbers only in thirty-seven of the states. Twenty-two states have a requirement as to the minimum amount of total plant food that can be guaranteed in mixed fertilizer.

In the main, these fertilizer control laws afford adequate information and protection to the consumer. In fact, it is not too much to say that fertilizer control is probably as severely enforced as supervision of foods and drugs. Except in minor respects, the consumer is placed in a position to select the fertilizer best suited to his needs and to be sure to receive what he buys.

These laws for the most part also protect the honest manufacturer from unfair practices of any competitor who may be tempted to resort to unscrupulous business conduct.

An occurrence of importance that should be mentioned in connection with fertilizer control laws was the organization in 1884 at Philadel-

phia of the Association of Official Agricultural Chemists. It was formed as a result of a meeting of chemists interested in methods of analyzing fertilizers, held in Atlanta in 1883. This body has played a highly important role in the development and administration of fertilizer control laws since that time. Mr. A. de Ghequier, then secretary of the National Fertilizer Association and of the Chemical and Fertilizer Exchange of Baltimore, was one of the group that aided in the founding of the Association of Official Agricultural Chemists.

Increase in Plant Food Content of Fertilizers

In 1880, the first year for which anything like accurate data are available, the average total plant food in complete mixed fertilizers was 13.4 per cent being composed of 2.3 per cent nitrogen. 8.9 per cent available phosphoric acid, and 2.2 per cent potash.

The total plant food content increased steadily till 1910 when it reached 14.9 per cent. In 1914, the scarcity of potash, diversion of nitrogen supply, and other economic factors interrupted the rising curve. Substantial falling off took place in plant food content so that even in 1920 the average was 13.9 per cent. By 1925, when supplies were normal again it had increased to 16.0 per cent, and by 1932 to 18 per cent. In 1936, it was 18.2 per cent composed of 3.7 per cent nitrogen, 9.1 per cent available phosphoric acid, and 5.4 per cent potash.

It is estimated that the average content of plant food in the complete mixed goods sold in 1940 will approximate 19 per cent. Although the tonnage in 1939 was approximately 8 per cent less than the tonnage sold in 1930, the amount of plant food furnished was approximately the same and cost the farmer about one-fourth less.

The average retail price per unit of plant food in fertilizers in 1880 was $2.98. The average plant food content was 13.4 per cent. Hence, the actual average retail price in 1880 was approximately $40.00 a ton.

The average plant food content in 1940 is about 19 per cent. If the average price per unit of plant food of $2.98 had been continued, the price per ton in 1940 would have been above $56.00. In point of fact, by reason of a reduction in price to approximately $1.50 per unit of plant food, the actual average retail cost per ton in 1940 was in the neighborhood of $28.00.

Progress in Production of Synthetic Nitrogen

The demand for Chilean nitrate of soda by American farmers had continued in fair volume alongside the growth of synthetic nitrogen production. In 1919, only 270 tons of synthetic nitrogen were produced (Muscle Shoals). Five years later, 1924, saw a production of 11,110 tons, while another five years later 84,000 tons were produced, according to the Fixed Nitrogen Research Laboratory of the United States Department of Agriculture.

In Report No. 114 of the U. S. Tariff Commission on Chemical Nitrogen issued in 1937, there are recorded eight synthetic nitrogen plants operating in 1934 with an estimated capacity of 341,350 tons of nitrogen per annum. No cyanamid is manufactured within the United States as the now wholly obsolete Government plant at Muscle Shoals, except the fraction used to manufacture concentrated superphosphate, has stood idle since 1919. The product of the American Cyanamid plant at Niagara Falls, Ontario, is to a large extent consumed in this country. No increase in this capacity since that time has come to our attention, but it is known that similar plants now producing synthetic methanol could be promptly diverted to the efficient fixation of nitrogen. Additional compounds such as ammonium nitrate, ammonium sulphate, urea, nitrate of soda, and solutions containing two or more of these compounds are now manufactured for use in fertilizer mixtures.

Catalytic oxidation of synthetic ammonia compounds into nitric acid and its derivatives is readily accomplished so that nitrates are available for either agriculture or munitions if and as they are needed. While our by-product and synthetic production of nitrogen is sufficient for all ordinary needs, with excess to spare, expansion can be made rapidly as necessity arises.

Potash Developments

From 1860, when potash mining began, to 1914, the world was entirely dependent on Europe for its mineral potash salts.

No brighter example of American ingenuity in industrial and engineering chemistry can be cited than the development of the domestic potash industry in the face of shortages brought on by the world war. Potential raw materials that promised to supply salts with the least difficulty were used first. Prices were several hundred per cent above normal, so that costs were a secondary consideration. When the war ended and imports from Europe were resumed, nearly all of these new enterprises were unable to meet foreign competition and went out of business. One establishment, now the American Potash and Chemical Corporation, which had been recovering potash from the brines of Searles Lake, California, since 1916,

(Continued on page 22)

About Cooperatives*

By RALPH B. DOUGLASS

Vice-President, Smith-Douglass Co., Inc., Norfolk, Va.

IN these days of "Isms"—Trojan horses—changes in forms of government, etc., etc. —is it not well to consider the rapid development in our midst of a vast movement which either has for its purpose, or the effect of which will be, if carried to its ultimate end, the complete elimination of all profit from commercial transactions? I am referring to the so-called "cooperative movement," and I consider it a topic worthy of the attention of every thinking American.

There is a "Cooperative League of the United States of America"—address of which is given as 167 West Twelfth Street, New York. It declares itself to be "an organization to spread the knowledge of the Consumers' Cooperative Movement, whereby the people, in voluntary association, purchase and produce for their own use the things they need." In their January, 1940, issue, under a caption "How Should Cooperators Describe Capitalism?" these statements will be found:

"We have been inclined to follow the rule 'speak gently about the dying' in discussing the present capitalistic economic system. Yet we sometimes wonder if we should not express our true feeling and use harsher words in indicting a system that has produced so much poverty, unemployment, tenancy, crime and war.

"Should we use such expressions as one writer did in The Nation, 'Capitalism is no longer able to make the rich rich enough so that the poor can get fat from the garbage.' "

In its December, 1939, issue, The Cooperative League boldly declared that:

"There can be no political peace without economic justice. There can be no justice in economic transactions in which there is profit.

" 'Any price in which there is a profit is not a just price,' as a striking advertisement of the Sydney Cooperative Society of Nova Scotia reads. Private profits mean 'robbing one's neighbor,' as another advertisement in the Midland Cooperator reads. Profits mean exploitation of one another, and there will be no 'Peace on Earth' until there are 'No Profits to Any.' "

The cooperative movement is sponsored and encouraged by both Federal and State governments and their agencies. The Secretary of Agriculture of the United States in a press release on April 25th, made the broad statement, "the cooperative way of doing things is peculiarly appropriate for the United States." This statement was made before the Senate agricultural subcommittee, considering authorizing the creation of a division of cooperatives in the Agriculture Department "to help promote the cooperative marketing and buying movement among farmers." It evidently was intended to concentrate all help in that division, because there is already much help from various government agencies.

There is, within the Federal Government, a bank that finances cooperatives with public funds at extremely low rates of interest. Mr. F. B. Bomberger, president of the Baltimore Bank for Cooperatives, delivered an address in which he supported this movement, and in which he said "Cooperation—the mere act of cooperating—is a privilege. It is a privilege for a number of individual farmers, or others, to use the corporate form of organization in order to escape the individual liability inherent in partnership action. It is a privilege for farmers' cooperatives to be exempted from income and certain business taxes. It is a special privilege provided by the Clayton amendment to the Sherman Anti-Trust Act, and the Capper-Volstead Act, for such cooperatives and the members thereof to be exempted from liability as illegal combinations on conspiracies in restraint of trade. It is a privilege for agriculture cooperatives to be able to enjoy and benefit by the special educational research, and financial services provided by Federal and State governmental agencies."

Bulletin No. 598 of the U. S. Bureau of Labor Statistics is entitled "Organization and Management of Consumers Cooperative Associations and Clubs." It says: "The average working man who thinks of joining a cooperative thinks of only a saving for himself the retailer's small net profit. He does not take due account of the fact that retail cooperative societies unite to form wholesales, and that these wholesales go into manufacturing and the production of raw materials, and that the great cooperative movement of the world is moving on to put into the pockets of the consumers

*From a letter written by Mr. Douglass to the editor of the "Ledger-Dispatch," Norfolk, Va. and published in their July 23rd issue.

that vast fund known as the 'profits of the business.' "

This cooperative movement exists in the form of farmer cooperatives, as well as consumer cooperatives. In the case of farmer cooperatives the greater strides have been made in the manufacturing and purchasing and the dealing in of various supplies required by the farmer, which he would normally buy from private manufacturers and dealers, rather than in connection with marketing of the farmers' products. There are a few cooperatives which function in the capacity of marketing the farmers' products and there are many who hold the view that there is a definite place in our economic life for these, because it affords farmers an opportunity to group together and improve the quality of the product they produce and in many ways to sell their product in a somewhat more businesslike way than if they operated individually. In some instances I am inclined to think there may be a place in the picture for this type of combination. There is a big difference, however, between this latter type of setup and others which have for their purpose the total elimination of private profit.

If the majority of the people of this country want to turn socialistic and eliminate private profit, then I say that is their privilege. I, personally, believe in our system of private enterprise and private profit. I think it is responsible in part, at least, for the great progress this country has made and for its unquestionably higher standard of living than that which exists in any other part of the world.

The real big quarrel which private enterprise has with the cooperatives is that these people who form cooperatives and who do their business through them are not contributing equally in taxes. The question has been important heretofore, but it is particularly pertinent at this time since the taxes of private enterprise are being increased and since there is every evidence they must be raised higher than at present. Every reasonable man accepts this increase in taxes willingly and gladly in order that we may prepare to defend ourselves against all outside threats, but are we not also interested in defending ourselves against any movement which may tend to change the traditional American system? Is not this thing about which I am writing a threat to some of the things we are attempting to protect? Is it not a boring from within?

As these co-ops pay no taxes (I am referring to Federal and State income taxes, to which they are completely exempt, and, I believe, certain other taxes also), it gives them a decided advantage over private enterprise. As this advantage attracts more volume of business to them, it means private enterprise must be taxed heavier and heavier on a constantly decreasing volume of business. How in the world would our State and Federal governments be supported if all business were done through cooperatives and they continued to be exempt from taxation?

These tax exemptions free the co-ops from a major item of expense, which private enterprise has to pay.

The cooperative has all the benefit of government that are given to others. If it has a fire, the same fire department comes to its rescue. The same police protection is afforded it as that which others get. The same sanitary, educational and every other governmental service is available to it and its members that others have. Why then should it not pay its fair share of the tax burden, which is necessary to support these essential functions of government? Through tax exemption it is the weapon with which to destroy everyone else's business.

I, personally, do not think there can be any compromise between those who believe the traditional American way of doing business is sound and should be continued and the forces which foster and are engaged in spreading the amazing doctrine that "profits mean exploitation of one another and there will be no 'peace on earth' until there are 'no profits to any.' "

This challenge is not to industry alone—it is directed to everyone who is engaged in any form of human endeavor in the hope of obtaining a reasonable return upon his investment of capital or labor.

C. C. SMITH TO RETIRE ON SEPT. 1ST

The Potash Company of America has announced that on September 1st, C. C. Smith will retire from the office of Vice-President in charge of sales, a position which he has held since 1934. Mr. Smith will continue with the company in the capacity of sales advisor, and will remain in touch with his many friends in the fertilizer industry.

Mr. Smith started his career in the fertilizer industry with the Armour organization, being salesman and manager from 1900 to 1909. He was general manager of the German Potash Syndicate from 1909 to 1918 and again from 1921 to 1933, when he resigned to head the sales department of the Potash Company of America.

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Principal Articles in This Issue

Truth in Advertising

A recent release of the Federal Trade Commission announces a stipulation with a producer of basic slag whereby certain representations for this material are to be discontinued.

The respondent agreed to desist from claims that its basic slag is always as good as superphosphate and frequently better; serves as well as acid phosphate for fertilizing purposes, or that its lime content makes it superior to superphosphate for winter legumes or other products. The respondent further agreed to cease implying that quotations from scientific authorities on basic slag are applicable to its basic slag product when such comments are in fact based upon other products.

Further representations or implications which the respondent agreed to discontinue are that lime makes available the potash in the soil; that the physical quality of all soil is improved by the application of lime; that magnesium oxide is lime or a form of lime; that manganese oxide changes crude forms of plant food into simpler and more usable forms; that a sufficient quantity of manganese is not usually present in all soils for any purpose for which that element is required, or that so "powerful" is the action of the manganese content of basic slag that it may properly be called a "chemical plow."

The work of the National Fertilizer Association through its Soil Improvement Committees and the educational efforts of the national and state agricultural departments have almost entirely removed from fertilizer advertising the ballyhoo of the early days, when exaggerated claims were considered necessary in any piece of literature. In fact, in the minds of many farmers, fertilizer came to be classed in the same category with circus posters and "patent medicine" testimonials. It is fortunate that the industry early in its history dropped this exaggerated form of selling its wares. The scientific presentation of the value of fertilizer will always be the best method of increasing its use.

POTASH DELIVERIES DURING FIRST HALF OF 1940

The American Potash Institute, Inc., announces that deliveries of agricultural potash by its Member Companies within the continental United States, Canada, Cuba, Puerto Rico, and Hawaii during the second quarter of the calendar year, 1940, amounted to 31,584 tons of actual K_2O, equivalent to 52,972 tons of potash salts. Constituting this total were 49,466 tons of muriate, 263 tons of manure salts, and 3,243 tons of sulphate. In addition, deliveries for chemical uses amounted to 15,384 tons of salts equivalent to 9,538 tons of K_2O. These figures include salts of domestic origin only. Based on import records of the Bureau of Foreign and Domestic Commerce potash imports in the form of chloride and sulphate salts during the second quarter amounted to approximately 29,133 short tons K_2O.

In terms of regional consignments, the total of 23,850 tons K_2O delivered within the continental United States was shipped as follows: Northeastern and Mid-Atlantic States, 5,415 tons; Southern States (including Virginia) 8,080 tons; Midwestern States 9,689 tons; and West Coast States 666 tons. The balance of 7,734 tons K_2O was delivered to Canada, Cuba, Puerto Rico and Wawaii.

For the first half of 1940 deliveries of agricultural K_2O amounted to 102,046 tons, equivalent to 175,903 tons of potash salts, consisting of 162,023 tons muriate; 4,124 tons manure salts; and 9,756 tons sulphate. Regional distribution on a K_2O basis was as follows: Northeastern and Mid-Atlantic States, 18,505 tons; Southern States (Virginia included) 42,665 tons; Midwestern States, 22,769 tons; West Coast States 2,998 tons; the remainder, 15,109 tons K_2O was delivered to Canada, Puerto Rico, and Hawaii. In addition, deliveries for chemical uses amounted to 29,013 tons of salts equivalent to 17,988 tons of K_2O. Imports of chloride and sulphate salts during the first half amounted to approximately 90,500 short tons of K_2O.

PETITT APPOINTED SALES HEAD OF POTASH COMPANY OF AMERICA

The sales department of Potash Company of America will be under the direction of George E. Petitt, beginning on September 1st. On that date he will assume the position of Vice-President in charge of sales, succeeding C. C. Smith, who is retiring.

Mr. Petitt has been associated with the fertilizer industry for many years, having been general superintendent of the Armour plant at Cartaret, N. J., and, from 1928 to 1934, superintendent of all the Armour plants throughout the country. He was associated with the Potash Company of America from 1934 to 1936 when he left to become first vice-president of the Chilean Nitrate Sales Corporation.

GERMAN NITROGENOUS FERTILIZER CONSUMPTION REGULATED

Consumption of nitrogenous fertilizers in Germany (old Reich) for 1940-41 will be restricted to 85 per cent of the quota base year 1938-39, when a total of 718,000 metric tons N was consumed. Consumption for 1940-41 will, therefore, presumably not exceed around 610,000 metric tons. Larger quotas, of 115 and 100 per cent of 1939-40, have been established for Austria and Sudetenland, having in view the low level of consumption in those areas heretofore compared with the Old Reich.

It has been found necessary to restrict national consumption of fertilizer nitrogen, notwithstanding Germany's large nitrogen productive capacity, which has been further enlarged by acquisition of large plants in Western Poland and Norway, owing to greatly expanded requirements of technical nitrogen for military operations.

It is believed that the consumption quotas established for 1940-41 will meet Germany's minimum agricultural needs and it is pointed out that these quotas represent a marked gain over Germany's consumption of nitrogenous fertilizer as compared with 1932-33, amounting to 335,000 metric tons N.

A drastic reduction in consumption of phosphate fertilizers has been found necessary and the consumption quota for 1940-41 is restricted to only around 346,000 metric tons P205, compared with 749,000 tons in 1938-39. This sharp reduction has been necessitated by the foreign origin of Germany's supply of phosphate rock and other crude phosphates and severe curtailment of imports caused by the Allied blockade.

Consumption of potassium fertilizers will continue unrestricted having in view Germany's abundant resources. However, despite these extensive resources, German potash producers were handicapped in supplying all of the national requirements in 1939-40 owing to shortages of fuel, rolling stock and labor, coupled with necessity of maintaining exports at maximum possible levels as a means of contributing to paying for Germany's imports of indispensable raw materials and foodstuffs. American Consulate General, Frankfort-on-Main.

CHILEAN NITRATE APPOINTS MYERS SALES VICE-PRESIDENT

Nelson Myers, manager of the Columbia, S. C., office of the Virginia-Carolina Chemical Corporation has resigned that position and will become first vice-president of the Chilean Nitrate Sales Corporation on September 1st. He will succeed George E. Petitt, who has resigned to become vice-president in charge of sales for the Potash Company of America.

Mr. Myers began his career in the industry with the Armour Fertilizer Works. He worked in its Nashville, Tenn., and Columbia, S. C., offices for about five years and then was named to the sales staff of the main office. In 1934 he joined the Virginia-Carolina organization, assigned to the Greensboro, N. C., office. He became assistant to the sales manager at the main branch one year later. He was named to his present position at Columbia in 1938.

PUERTO RICAN FERTILIZER SALES INCREASE

Puerto Rico's purchases of fertilizers from continental United States set a new high record during the fiscal year just ended, totalling 123,100 tons, or 112 per cent more than in the preceding year, according to a statement by the Puerto Rican Trade Council. The previous high record was set in 1937 when shipments reached 120,800 tons.

The value of the fertilizer sales to the territory was $3,340,000, an increase of 151 per cent over the year before. Ammonium sulphate shipments, totalling 75,020 tons, were 156 per cent greater, while sales of superphosphate were 17 per cent higher, amounting to 18,200 tons.

The demand for fertilizers in Puerto Rico picked up sharply following the four-month suspension of sugar quotas last fall, when there was prospect of unrestricted sugar production during the coming years. Although quotas subsequently were restored, the territory was permitted to harvest a normal carryover of sugar during the 1940 season. Total sugar production was 1,019,000 tons for the year, as compared with an estimated 870,000 tons during 1941 under the terms of proposed sugar legislation.

Sales of all goods to Puerto Rico during the fiscal year were valued at $100,500,000, also the largest on record, an increase of 33 per cent as compared with 1938-39.

"ADVERTISING AS A CAREER"

For all ambitious people interested in increasing their efficiency in marketing in its various fields, a new and remarkable Vocational Guide has just been published. Because it is keyed to the idea of helping people make more money, over 6,000 copies have been distributed in a few months.

This book is called: "Advertising As A Career," by Mark O'Dea and 65 leading authorities in business and universities. While it is especially focused on advertising as a form of selling, it covers a wide range of merchandising, being 65,000 words, condensed into 128 pages. It is widely acclaimed as the most authoritative, comprehensive book ever published in this field . . . compact, well-organized, up-to-the-minute.

"Advertising As A Career" is distributed by the author as a private, non-profit contribution to Vocational Guidance, his favored interest in education. This book may be had at cost of printing and postage. For a complete circular describing "Advertising AS A Career" one may write to Mark O'Dea, 400 Madison Avenue, New York City.

FERTILIZER MATERIALS MARKET

NEW YORK

Sulphate of Ammonia and Muriate of Potash Difficult to Obtain for Export. New Nitrate of Soda Prices Awaited.

Exclusive Correspondence to "The American Fertilizer."

NEW YORK, July 30, 1940.

It is becoming more and more difficult to obtain sulphate of ammonia for export with some demand continuing, and prices for such quantities as are obtainable for export continue to increase.

There is also demand for muriate of potash for export but most of the sellers who have been willing to offer this material for export have withdrawn all offerings and at the present time it is most difficult to obtain any quotation for export.

Regarding nitrate of soda, up to noon July 30th, no prices have been issued for August or later delivery but it is expected that such new prices will be available shortly.

Castor Pomace

Domestic material can be bought at about $14.50 per ton. No prices are available for imported material.

Fish Scrap

Sales were made at $3.35 ($4.07 per unit N) and 10 cents but available supplies are still scarce.

Dried Blood

There is no demand and no change in the market. South American is quoted at $2.35 ($2.85½ per unit N) and domestic offered at $2.25 ($2.73½ per unit N).

Sulphate of Ammonia

Price for domestic consumption is $28.00 but in many cases buyers are finding it difficult to obtain material for delivery to points where required.

Potash

There is no change in the price of 53½ cents per unit K_2O, less 12 per cent, but it is evident that domestic suppliers are allocating tonnage and probably in most cases domestic fertilizer manufacturers have very little, if any, material for resale for export.

Superphosphate

The market is unchanged and firm at $8.50 per ton for run-of-pile material.

ATLANTA

Materials Market Waiting on War Developments. Sulphate of Ammonia Scarce. Shortage of South American Organics.

Exclusive Correspondence to "The American Fertilizer."

ATLANTA, July 30, 1940.

There are very few radical price changes to report in the fertilizer materials market due to the fact that business generally is marking time and awaiting the outcome of international developments. If the war in Europe continues, it will inevitably mean that this country will be called on to supply a large part of the materials that have heretofore come from Europe; inquiries at present are plentiful but actual bookings are limited except for nearby delivery.

Sulphate of ammonia seems to be pretty well sold up, with the producers giving preference to specific monthly deliveries where a premium is to be had. It is now difficult, if not impossible, to book ten months' contracts.

It is reported that, due to the European blockade, the slaughtering in South America has been decreased about 50 per cent which will mean a material reduction in the supply of blood, tankage, bone meal, etc. Great Britain has been a buyer in that market recently and prices are somewhat firmer.

The current markets are as follows:

Blood.—Imported, $2.50 ($3.04 per unit N).

Tankage.—$2.60 ($3.16 per unit N) and 10 cents.

Fish Scrap.—Menhaden Chesapeake Bay material available at $3.25 ($3.95 per unit N) and 10 cents subject to production, buyers bags.

Acidulated Fish.—Nothing offered.

Nitrate of Soda.—Unchanged.

Sulphate of Ammonia.—As per above

Cottonseed Meal.—Firmer, September/October $22.00 to $22.50, basis f.o.b. Memphis.

Steam Bone Meal.—3 and 50 per cent, $31.00.

Raw Bone Meal.—4½ and 45 per cent. $31.50.

BALTIMORE

Little Activity in Materials Market. Sulphate of Ammonia and Potash Relatively Scarce. Feed Market Dull.

Exclusive Correspondence to "The American Fertilizer."

BALTIMORE, July 30, 1940.

There is very little activity in the market on fertilizer materials at the present time, although it is understood some of the manufacturers have been experiencing difficulty in booking for their full requirements of sulphate of ammonia and potash.

Ammoniates.—South American ground dried blood is still obtainable around $2.75 to $2.80 per unit of Nitrogen. The market on domestic tankage is around the same levels, and we are now going into the dull consuming period of the feeding business, there is comparatively little interest being shown in organic ammoniates at the present time for feeding purposes.

Nitrogenous Material.—Buying is practically at a standstill, and the nominal market continues unchanged at $2.55 to $2.65 per unit of nitrogen for domestic goods.

Sulphate of Ammonia.—The situation on this material is tightening up right along, and while first hands have not made any change in their schedule, it is impossible to purchase any tonnage, as some of the buyers who have not yet fully covered for their requirements are marking time in the hope that European war conditions may ease up the demand for sulphate, and leave a larger tonnage available for domestic consumption.

Nitrate of Soda.—It is anticipated that importers as well as domestic producers will shortly name prices on bagged nitrate, and as burlap is ruling somewhat higher than last year, the trade is anticipating slightly higher prices for the coming season. The market for bulk material remains unchanged at $27.00 per ton of 2,000 lb., ex-warehouse ports.

Fish Scrap.—Small sales have been reported at the equivalent of $4.07 per unit of nitrogen, but as this price is so much higher than other feeding materials, buying interest is at a minimum.

Superphosphate.—The market remains unchanged at $8.00 per ton of 2,000 lb., basis 16 per cent, for run-of-pile, and $8.50 for flat 16 per cent grade, both in bulk, f.o.b. sellers' works, Baltimore.

Bone Meal.—There is very little interest being shown in either raw or steamed bone meal on account of comparatively high prices prevailing. Domestic 3 and 50 per cent steamed bone meal ranges from $32.00 to $34.00 per ton of 2,000 lb., while 4½ and 50 per cent raw bone is quoted at $31.50 to $32.00 per ton, c.i.f. Baltimore.

Potash.—It is understood that importers have now disposed of their warehouse stocks, and some of the manufacturers have not been able to fully cover for their wants. Domestic producers are going very slowly in booking additional business, but should they be able to increase production by spring and supply a larger per centage of domestic requirements, manufacturers will not be able to secure the benefit of early buying discounts. Some of the manufacturers are beginning to show concern over this situation.

Bags.—The burlap market is ruling slightly easier than prevailed two weeks ago, and the present price of plain, new, 10-oz. bags, basis 40 cut 54 in., is about $109.00 per thousand, delivered Baltimore, for fall and spring shipment.

WILMINGTON

Fish Catch Improves but Producers Behind in Deliveries. Some Activity in Cottonseed Meal. Hot Weather Aids Cotton Crop.

Exclusive Correspondence to "The American Fertilizer."

WILMINGTON, July 29, 1940.

Little activity is noted in the fertilizer materials market here. The catch of menhaden fish has improved and the movement of contract deliveries is progressing. However, the producers are yet far behind in their deliveries and few are anxious sellers yet. The market is somewhat easier. Acidulated scrap can be bought for $2.50 ($3.04 per unit N) and 50 cents at Carolina points but Florida producers continue to ask $3.00 ($3.64½ per unit N) and 50 cents. Dried scrap is quoted at from $42.00 to $44.00 per ton at North Carolina plants.

Some interest is being shown in cottonseed meal, but it is not buying interest. Many of the buyers who have carry-over stocks seem to believe they should sell these stocks and buy from the new crop later in the fall. However, absence of buyers makes their position a little difficult.

The extremely hot wave has done some damage to the tobacco crop but cotton has thrived on it and reports indicate one of the best cotton crops in years.

CHICAGO

Fertilizer Organic Market Quiet. Sellers Maintaining Prices. Feed Material Prices Advance.

Exclusive Correspondence to "The American Fertilizer."

CHICAGO, July 29, 1940.

Not much action is noted in the organic market. Some bids for fall and later deliveries have again been made but, being below sellers' views, no actual trades of consequence can be reported. Sellers seem determined, at this time, to hold out for a market in keeping with their ideas of value.

Increased inquiry for steamed bone meal is current, but sales are limited to the light offerings.

The materials in the feed market have experienced a decided advance, owing to a further

increase in the lists for digester tankage and meat scraps.

Nominal prices are as follows: high grade ground fertilizer tankage, $2.00 to $2.25 ($2.43 to $2.73½ per unit N) and 10 cents; standard grades crushed feeding tankage, $2.60 to $2.75 ($3.16 to $3.34½ per unit N) and 10 cents; blood, $2.60 to $2.65 ($3.16 to $3.22 per unit N); dry rendered tankage, 60 to 62½ cents per unit of protein, Chicago basis.

PHILADELPHIA

Materials Market Dull. New Prices of Bagged Nitrate of Soda Awaited with Interest.

Exclusive Correspondence to "The American Fertilizer."

PHILADELPHIA, July 31, 1940.

The fertilizer materials market remains dull. Interest seems to center on bagged nitrate of soda prices for the coming year. While the bulk price remains the same, it is rumored that bagged goods may be increased, due to the higher cost of bags. Organics remain about the same with little demand.

Nitrate of Soda.—Deliveries on extended contracts fair. Trade awaits new bagged price for coming season.

Sulphate of Ammonia.—Very firm. Export demand seems heavier.

Dried Blood.—No particular interest being shown by buyers. Nominal price, $2.30 to $2.35 ($2.79½ to $2.85½ per unit N).

Tankage.—Quiet. Material being offered at $2.25 ($2.73½ per unit N) and 10 cents.

Bone Meal.—Firm. 1 and 65 per cent about $34.00 to $35.00; 3 and 50 per cent at $32.50 to $33.00; 4½ and 45 per cent about $34.00 to $35.00.

Superphosphate.—Steady. $8.00 per ton for run-of-pile; $8.50 for 16 per cent.

TENNESSEE PHOSPHATE

New Phosphorus Furnaces Under Construction Will Greatly Increase Capacity. New TVA Furnace Expected.

Exclusive Correspondence to "The American Fertilizer."

COLUMBIA, TENN., July 29, 1940.

Following closely on the recent press reports that Monsanto was soon to start the erection of another phosphorus furnace at its plant near Columbia, comes the report of actual start of construction. The new furnace, however, instead of being equal in capacity to all three existing furnaces, thus increasing productive capacity for elemental phosphorus 100 per cent, will be fifty per cent larger than one of the old ones, increasing the total capacity 50 per cent. The construction work has gotten well under way for this enlargement, and operation is expected early in January.

During the past week the Victor Chemical Works began construction of a fourth furnace at their Mt. Pleasant plant, said to be of the same size as the existing ones. This addition will be ready for operation January 1, 1941.

Thus the total productive capacity of elemental phosphorus in this county will be increased over 42 per cent.

TVA has finally registered deed showing purchase of the tract of land north of Duck River and east of the L. & N. R.R. at Godwin, Tenn., north of Columbia and a few miles south of their large sub-station at Kraus' Crossing, where rumor has predicted for a year or two that their blast furnace plant to produce phosphorus for manufacturing calcium metaphosphate by TVA would be located. The site is fairly centrally located for handling phosphate ores from the various TVA owned or operated properties in Estes and Roberts Bend of Duck River, Knob Creek and Godwin areas, Bear Creek area in Maury County, and the Franklin and West Harpeth areas of Williamson County,

while railroad transportation is reasonably close for their Davidson and Sumner Co. property.

Activities of the large furnace operators have called to mind the story of the two Dutch bakers whose places of business were on opposite sides of the same street, and who indulged in great rivalry as to plant extensions, larger sized loaves of bread, lower priced loaves, etc. Finally one of them died and a provision in his will resulted in the erection of a large monument alongside his bakery, bearing the inscription, "Here I lie, snug as a bug in a rug." This seemed to be an absolute quietus on the competitive race, but before long the survivor erected a larger size monument by his shop, with the inscription, "Here I will lie, much snugger than the other bugger."

At any rate the competition of the Government agency and the two private concerns has been highly appreciated by the citizens of Maury County and the representatives of all three organizations are personae gratae with every one in the County and are all most active and highly considered members of the community.

The past week has awakened this area from its dream of becoming a summer resort rivalling the Canadian woods, with temperatures ranging constantly in the high nineties and the corn and tobacco suffering enormously, as well as the citizenry and the livestock.

CLASSIFIED ADVERTISEMENTS

Advertisements for sale of plants, machinery, etc., and for help and employment, in this column, same type as now used, 60 cents per line, each insertion.

FOR SALE

THEW Electric Shovel, cheap, fair condition. Address "Fertilizer Shovel," care THE AMERICAN FERTILIZER, Philadelphia.

A CENTURY OF PLANT FOOD PROGRESS

(Continued from page 9)

perfected its processes and has continued in successful operation.

Potash mineral deposits were discovered in the Permian Basin of New Mexico, in 1921. Workable deposits were found at Carlsbad, New Mexico, about 1926. Mining began in 1931-32, and new processes for concentration of the potash content of the ore were installed by the United States Potash Company and the Potash Company of America, each resorting to different methods of refining.

The first three American producers mentioned above produce approximately two-thirds of our potash needs. A third producer in the Carlsbad area is the Union Potash and Chemical Company which expects to be in production this fall. From a beginning of 1,090 tons of production in 1915, output increased to approximately 317,000 tons of K_2O in 1938.

Superphosphate Progress

First made in 1842-43, in less than 100 years, world production of superphosphate reached a total of 17,180,000 short tons, basis 16 per cent, in 1937. That same year the United States production reached 4,800,000 tons. The 1939 production however decreased somewhat in the United States totaling only 4,175,000 tons. These figures include both normal superphosphate and concentrated superphosphate. This tonnage was produced in 191 plants as to the normal grades and 8 plants including TVA as to concentrated superphosphate. The capacity of existing plants to produce normal superphosphate is more than twice the amount ever used in any year up to 1937.

The production of concentrated superphosphate has been greatly stimulated the last two or three years by the program of the Agricultural Adjustment Administration which includes the distribution of superphosphate as grants-in-aid

See Page 4

in lieu of cash payments earned through compliance with the provisions of the soil conservation program. They so distribute all the surplus production of Tennessee Valley Authority and other tonnage purchased from commercial manufacturers. It is expected that between 160,000 and 175,000 tons of concentrated superphosphate will be distributed by AAA in its 1940 program. In addition they will distribute a very considerable tonnage of normal superphosphate.

Domestic capacity to produce concentrated superphosphate up to a year or so ago has always exceeded the demand. The agricultural program has changed the situation. However, when our last survey was made in 1937, private capacity to produce the concentrated material was approximately 213,000 tons. There has been some increase but its extent has not been determined. In addition, in 1939 TVA produced 68,926 tons, of which 50,671 tons were sold to the Agricultural Adjustment Administration and 18,255 tons used in the TVA's own distribution, chiefly in the Tennessee Valley States. The balance of the AAA distribution was obtained from private industry.

Raw Rock Phosphate

Use of raw rock phosphate is confined to the United States and here to a few areas. Foreign countries use negligible amounts; in fact some countries prohibit its sale, because of the unavailable form of its P_2O_5.

It is estimated that approximately 60,000 tons of ground raw rock phosphate are applied direct each year, largely in the states of Illinois and Florida.

Basic Slag

Basic slag is used only slightly in the United States, 1937 consumption being about 36,000 total tons. All of this was produced in the Birmingham, Alabama, area. It contained only about 8 per cent of total P_2O_5, while European slag contains about 17 per cent.

Minor Plant Foods

Discoveries calling for the use of minor plant foods have waited for deficiencies of them to appear in our crop lands. Real recognition of the need and importance of them has developed gradually, but for the most part during the past 20 years.

With the exception of the three primary plant foods, nitrogen, phosphoric acid, and potash, most agricultural soils originally contained a sufficient amount of the other mineral plant foods to supply the needs of crops. Many soils still contain an adequate supply of these minerals. There are certain areas, however, where there is a deficiency of one or more of these elements, and other areas where the soil is no doubt rapidly approaching the point where there will not be enough of some plant food to produce a normal crop. When such a condition occurs, it is necessary to supply the deficiency in plant food either in the fertilizer mixture or in some other manner if production is to be maintained. These deficiencies produce typical symptoms in growing plants, originally thought to be diseases but now generally recognized. For instance, "sand drown" of tobacco is a symptom of magnesium deficiency. Black heart of sugar beets, cracked stem in celery, and cork spot in apples are all symptoms of boron deficiency, and the rosette disease of pecan and other trees is a symptom of zinc deficiency.

Many others might be mentioned in connection with deficiencies of calcium, manganese, copper, sulphur, and iron, the other necessary plant foods. These so-called minor plant food elements will undoubtedly become increasingly important in our fertilizer picture.

Growth of the Fertilizer Industry in Physical Equipment

In 1860, the first time the fertilizer industry was given separate treatment in the reports of the Bureau of the Census, 47 firms were reported as engaged in manufacture. Of these, 40 were said to have been new firms, indicating that only seven existed at some near prior date.

The 47 establishments reported in 1860 employed only 308 hands. Today there are approximately 98 plants that manufacture sulphuric acid, superphosphate, and mixed fertilizers; 95 that produce superphosphate, buying their sulphuric acid, and also produce mixed fertilizers, and 725 mixed fertilizer factories. Needless to say, production capacity gravely ex-

ceeds consumer demand. Peak employment has ranged from 28,000 to 35,000 persons over a period of years.

Lower Prices for the Consumer

Ninety-seven years ago this summer, one of the first advertisements of chemical fertilizer published anywhere in the world appeared in the GARDENER'S CHRONICLE in England. It offered the "patent manures" and "superphosphate of lime" of J. B. Lawes at about $25 a ton. Production costs were of course greatly less than they are today in American plants, particularly in regard to labor costs. As Sir John Russell told us at our 1927 convention here at White Sulphur Springs, "I leave you to judge the profit he (Lawes) made. You will not be surprised to learn that thirty years later he sold the business for a great sum of money."

In those early days, of course, superphosphate was not yet being used in this country so no quotations are available. For many years guano was the principal fertilizer sold here, with our imports in 1853-1854 amounting to 175,849 tons. An article on guano in the Report of the Commissioner of Patents for the Year 1854 stated that Peruvian guano as then sold in this country was worth about $54 a ton. Our guano imports that year were thus valued at more than $9,000,000. The average price of a ton of complete fertilizer today is approximately half that of guano in 1854.

The cost of plant food to farmers has fallen off much more over a period of years than has the price of fertilizer per ton, due to the increase in plant food content. In 1880, for instance, the average superphosphate contained only 11 per cent of available P_2O_5 while today it contains more than 18 per cent.

Sixty years ago the average retail price per unit of total plant food in a complete mixture was $2.98. Today it is $1.49, just half as much. The price of superphosphate is less than half of the 1880 price. This comparison is of particular interest when we keep in mind that the general price level, for all commodities, is now higher than it was in 1880. For all commodities, an increase; for fertilizer, a 50 per cent decrease.

The progress made by the fertilizer industry in reduced costs and increased plant foods means a saving to the American farmer of about $200,000,000 annually.

The world is confronted with a new and uncertain day. We all need both spiritual and material preparedness. During the World War, the fertilizer industry, and many of us as individuals, contributed as best we could in the Nation's crisis. Now, as then, agriculture and the industries related to it are an indispensable part of true preparedness to protect our real interests. The problems that confront us differ in many respects from those of 1917, but the same need for self-discipline and for capable, informed, and constructive leadership prevails.

Sufficient production of food and fiber are basic to any military preparedness and as necessary today as ever before. However, with huge surpluses of cotton and grain here, and with greatly increased production in other parts of the world, the reliance of belligerent countries upon us for supplies has greatly decreased. Brazil, the British Empire, India, and Russia have increased their cotton production. Italy, the Balkans, Russia, Argentina, Australia, and other areas have speeded up their production of grains to a level higher than that prevailing from 1914 to 1918. We must do our intelligent part in every respect, remembering that peace will return to the world, and progress will continue in our industry, on our farms, and throughout our Nation.

BUYERS' GUIDE

A CLASSIFIED INDEX TO ALL THE ADVERTISERS IN "THE AMERICAN FERTILIZER"

This list contains representative concerns in the Commercial Fertilizer Industry, Including fertilizer manufacturers, machinery and equipment manufacturers, dealers in and manufacturers of commercial fertilizer materials and supplies, brokers, chemists, etc.
For Alphabetical List of Advertisers, see page 33.

ACID BRICK
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

ACID EGGS
Chemical Construction Corp., New York City.

ACIDULATING UNITS
Chemical Construction Corp., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

AMMO-PHOS
American Cyanamid Co., New York City.

AMMONIA—Anhydrous
Barrett Company, The, New York City.
Du Pont de Nemours & Co., E. I., Wilmington, Del.
Hydrocarbon Products Co., New York City.

AMMONIA LIQUOR
Barrett Company, The, New York City.
Du Pont de Nemours & Co., E. I., Wilmington, Del.
Hydrocarbon Products Co., New York City.

AMMONIA OXIDATION UNITS
Chemical Construction Corp., New York City.

AMMONIATING EQUIPMENT
Sackett & Sons Co., The A. J., Baltimore, Md.

AUTOMATIC ELEVATOR TAKEUPS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

BABBITT
Sackett & Sons Co., The A. J., Baltimore, Md.

BAGS AND BAGGING—Manufacturers
Bagpak, Inc., New York City.
Bemis Bro. Bag Co., St. Louis, Mo.
Fulton Bag & Cotton Mills, Atlanta, Ga.

BAGS—Cotton
Bemis Bro. Bag Co., St. Louis, Mo.
Fulton Bag & Cotton Mills, Atlanta, Ga.

BAGS—Paper
Bagpak, Inc., New York City.
Bemis Bro. Bag Co., St. Louis, Mo.

BAGS (Waterproof)—Manufacturers
Bemis Bro. Bag Co., St. Louis, Mo.
Fulton Bag & Cotton Mills, Atlanta, Ga.

BAGS—Dealers and Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

BAGGING MACHINES—For Filling Sacks
Atlanta Utility Works, East Point, Ga.
Bagpak, Inc., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

BAG-CLOSING MACHINES
Bagpak, Inc., New York City.

BAG PILERS
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.

BEARINGS
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

BELT LACING
Sackett & Sons Co., The A. J., Baltimore, Md.

BELTING—Chain
Atlanta Utility Works, East Point, Ga.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

BELTING—Leather, Rubber, Canvas
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Sackett & Sons Co., The A. J., Baltimore, Md.

BOILERS—Steam
Atlanta Utility Works, East Point, Ga.

BONE BLACK
American Agricultural Chemical Co., New York City.
Armour Fertilizer Work, Atlanta, Ga.
Huber & Company, New York City.

BONE PRODUCTS
American Agricultural Chemical Co., New York City.
Armour Fertilizer Work, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

BORAX AND BORIC ACID
American Potash and Chem. Corp., New York City.
Pacific Coast Borax Co., New York City.

BROKERS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Keim, Samuel L., Philadelphia, Pa.
Schmaltz, Jos. H., Chicago, Ill.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

BUCKETS—Elevator
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

A Classified Index to Advertisers in "The American Fertilizer"

BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 33

BUCKETS—For Hoists, Cranes, etc., Clam Shell, Orange Peel, Drag line, Special; Electrically Operated and Multi Power
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.

BURNERS—Sulphur
Chemical Construction Corp., New York City.

BURNERS—Oil
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.

CABLEWAYS
Hayward Company, The, New York City.

CALCIUM-NITRATE
Synthetic Nitrogen Products Co., New York City.

CAL-NITRO
Synthetic Nitrogen Products Co., New York City.

CARBONATE OF AMMONIA
American Agricultural Chemical Co., New York City.
Du Pont de Nemours & Co., E. I., Wilmington, Del.

CARS—For Moving Materials
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CARTS—Fertilizer, Standard and Roller Bearing
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

CASTINGS—Acid Resisting
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

CASTINGS—Iron and Steel
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CEMENT—Acid-Proof
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

CHAIN DRIVES—Silent
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAINS AND SPROCKETS
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAMBERS—Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

CHEMICAL APPARATUS
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

CHEMICALS
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Company, The, New York City.

CHEMICALS—Continued
Bradley & Baker, New York City.
Du Pont de Nemours & Co., E. I., Wilmington, Del.
Huber & Company, New York City.
Wellmann, William E., Baltimore, Md.

CHEMICAL PLANT CONSTRUCTION
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHEMISTS AND ASSAYERS
Gascoyne & Co., Baltimore, Md.
Stillwell & Gladding, New York City.
Wiley & Company, Baltimore, Md.

CLUTCHES
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CONCENTRATORS—Sulphuric Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

CONDITIONERS AND FILLERS
American Limestone Co., Knoxville, Tenn.

CONTACT ACID PLANTS
Chemical Construction Corp., New York City.

COPPER SULPHATE
Tennessee Corporation, Atlanta, Ga.

COTTONSEED PRODUCTS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

CRANES AND DERRICKS
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Link-Belt Speeder Corp., Chicago, Ill. and Cedar Rapids, Iowa.
Sackett & Sons Co., The A. J., Baltimore, Md.

CYANAMID
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Jett, Joseph C., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

DENS—Superphosphate
Chemical Construction Corp., New York City.
Stedman's Foundry and Mach. Works, Aurora, Ind.

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DISINTEGRATORS
Atlanta Utility Works, East Point, Ga.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

DOUBLE SUPERPHOSPHATE (See Superphosphate—Concentrated)

DRYERS—Direct Heat
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Sackett & Sons Co., The A. J., Baltimore, Md.

DRIVES—Electric
Link-Belt Company, Philadelphia, Chicago.

DUMP CARS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

DUST COLLECTING SYSTEMS
Sackett & Sons Co., The A. J., Baltimore, Md.

ELECTRIC MOTORS AND APPLIANCES
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

ELEVATORS
Atlanta Utility Works, East Point, Ga.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

ELEVATORS AND CONVEYORS—Portable
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

ENGINEERS—Chemical and Industrial
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

ENGINES—Steam
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

EXCAVATORS AND DREDGES—Drag Line and Cableway
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Link-Belt Speeder Corp., Chicago, Ill. and Cedar Rapids, Iowa.

FERTILIZER MANUFACTURERS
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Farmers Fertilizer Co., Columbus, Ohio.
International Agricultural Corp., New York City.
Smith-Rowland Co., Norfolk, Va.
U. S. Phosphoric Products Corp., New York City.

FISH SCRAP AND OIL
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

FOUNDERS AND MACHINISTS
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

GARBAGE TANKAGE
Wellmann, William E., Baltimore, Md.

GEARS—Machine Moulded and Cut
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

GEARS—Silent
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

GELATINE AND GLUE
American Agricultural Chemical Co., New York City.

GUANO
Baker & Bro., H. J., New York City.

HOISTS—Electric, Floor and Cage Operated, Portable
Hayward Company, The, New York City.
Jeffrey Manufacturing Co., The, Columbus, Ohio.

HOPPERS
Atlanta Utility Works, East Point, Ga.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

IMPORTERS, EXPORTERS
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Wellmann, William E., Baltimore, Md.

IRON SULPHATE
Tennessee Corporation, Atlanta, Ga.

INSECTICIDES
American Agricultural Chemical Co., New York City.

LACING—Belt
Sackett & Sons Co., The A. J., Baltimore, Md.

LIMESTONE
American Agricultural Chemical Co., New York City.
American Limestone Co., Knoxville, Tenn.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Wellmann, William E., Baltimore, Md.

LOADERS—Car and Wagon, for Fertilizers
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Acid Making
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Coal and Ash Handling
Hayward Company, The, New York City.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Elevating and Conveying
Atlanta Utility Works, East Point, Ga.
Hayward Company, The, New York City.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
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Atlanta Utility Works, East Point, Ga.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Power Transmission
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Pumping
Atlanta Utility Works, East Point, Ga.

MACHINERY—Tankage and Fish Scrap
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MAGNESIA
California Chemical Co., New York City.

MAGNETS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MANGANESE SULPHATE AND CARBONATE
Tennessee Corporation, Atlanta, Ga.

MANGANESE SULPHATE
Tennessee Corportion, Atlanta, Ga.

MIXERS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

NITRATE OF SODA
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Company, The, New York City.
Bradley & Baker, New York City.
Chilean Nitrate Sales Corp., New York City.
Huber & Company, New York City.
International Agricultural Corp., New York City.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

NITRATE OVENS AND APPARATUS
Chemical Construction Corp., New York City.

NITROGENOUS ORGANIC MATERIAL
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Du Pont de Nemours & Co., E. I., Wilmington, Del.
Huber & Company, New York City.
International Agricultural Corp., New York City.
Smith-Rowland Co., Norfolk, Va.
Wellmann, William E., Baltimore, Md.

NOZZLES—Spray
Monarch Mfg. Works, Inc., Philadelphia, Pa.

PACKING—For Acid Towers
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

PANS AND POTS
Stedman's Foundry and Mach. Works, Aurora, Ind.

PHOSPHATE MINING PLANTS
Chemical Construction Corp., New York City.

PHOSPHATE ROCK
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Charleston Mining Co., Inc., Richmond, Va.
Huber & Company, New York City.
International Agricultural Corp., New York City.
Jett, Joseph C., Norfolk, Va.
Ruhm, H. D., Mount Pleasant, Tenn.
Schmaltz, Jos. H., Chicago, Ill.
Southern Phosphate Corp., Baltimore, Md.
Taylor, Henry L., Wilmington, Del.
Wellmann, William E., Baltimore, Md.

PIPES—Chemical Stoneware
Chemical Construction Corp., New York City.

PIPES—Wooden
Stedman's Foundry and Mach. Works, Aurora, Ind.

PLANT CONSTRUCTION—Fertilizer and Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

POTASH SALTS—Dealers and Brokers
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Agricultural Corp., New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Synthetic Nitrogen Products Co., New York City.
Taylor, Henry L., Wilmington, Del.
Wellmann, William E., Baltimore, Md.

POTASH SALTS—Manufacturers and Importers
American Potash and Chem. Corp., New York City.
Potash Co. of America, Baltimore, Md.
United States Potash Co., New York City.

PULLEYS AND HANGERS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

PUMPS—Acid-Resisting
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

PYRITES—Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Jett, Joseph C., Norfolk, Va.
Wellmann, William E., Baltimore, Md.

QUARTZ
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

RINGS—Sulphuric Acid Tower
Chemical Construction Corp., New York City.

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Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

SCALES—Including Automatic Bagging
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SCRAPERS—Drag
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.

SCREENS
Atlanta Utility Works, East Point, Ga.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SEPARATORS—Air
Sackett & Sons Co., The A. J., Baltimore, Md.

SEPARATORS—Including Vibrating
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

SEPARATORS—Magnetic
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SHAFTING
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SHOVELS—Power
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Link-Belt Speeder Corp., Chicago, Ill. and Cedar Rapids, Iowa.
Sackett & Sons Co., The A. J., Baltimore, Md.

SPRAYS—Acid Chambers
Monarch Mfg. Works, Inc., Philadelphia, Pa.

SPROCKET WHEELS (See Chains and Sprockets)

STACKS
Sackett & Sons Co., The A. J., Baltimore, Md.

SULPHATE OF AMMONIA
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Company, The, New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Hydrocarbon Products Co., New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Snythetic Nitrogen Products Co., New York City.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

SULPHUR
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Freeport Sulphur Co., New York City.
Texas Gulf Sulphur Co., New York City.

SULPHURIC ACID
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.

SULPHURIC ACID—Continued
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
U. S. Phosphoric Products Corp., New York City.
Wellmann, William E., Baltimore, Md.

SUPERPHOSPHATE
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Agricultural Corp., New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Taylor, Henry L., Wilmington, N. C.
U. S. Phosphoric Products Corp., New York City.
Wellmann, William E., Baltimore, Md.

SUPERPHOSPHATE—Concentrated
Armour Fertilizer Works, Atlanta, Ga.
International Agricultural Corp., New York City.
U. S. Phosphoric Products Corp., New York City.

SYPHONS—For Acid
Monarch Mfg. Works, Inc., Philadelphia, Pa.

TALLOW AND GREASE
American Agricultural Chemical Co., New York City.

TANKAGE
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
International Agricultural Corp., New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Smith-Rowland Co., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

TANKAGE—Garbage
Huber & Company, New York City.

TANKS
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Sackett & Sons Co., The A. J., Baltimore, Md.

TILE—Acid-Proof
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

TOWERS—Acid and Absorption
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

UNLOADERS—Car and Boat
Hayward Company, The, New York City.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

UREA
Du Pont de Nemours & Co., E. I., Wilmington, Del.
Snythetic Nitrogen Products Co., New York City.

UREA-AMMONIA LIQUOR
Du Pont de Nemours & Co., E. I., Wilmington, Del.

VALVES—Acid-Resisting
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

WHEELBARROWS (See Carts)

ZINC SULPHATE
Tennessee Corporation, Atlanta, Ga.

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